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Thursday 2 February 2012 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE ADDITIONAL SCIENCE A

A217/01 Unit 3: Modules B6 C6 P6 (Foundation Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 40 minutes

* A 2 1 7 0 1 *

* 6 5 7 1 6 6 4 2 9 9 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **42**.
- A list of physics equations is printed on page 2.
- The Periodic Table is printed on the back page.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful Relationships

Explaining Motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{change in energy} = \text{work done}$$

$$\text{change in GPE} = \text{weight} \times \text{vertical height difference}$$

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric Circuits

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{potential difference} \times \text{current}$$

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

The Wave Model of Radiation

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

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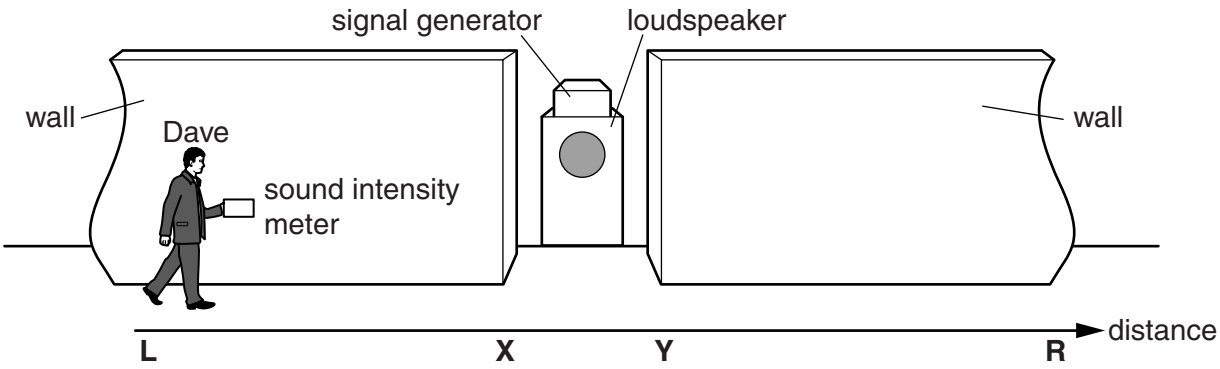
Question 1 begins on page 4

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Dave does an experiment with sound waves.

He places a loudspeaker and a signal generator behind a gap in a wall.



The loudspeaker sends sound waves towards the gap.

Dave walks in front of the wall with a sound intensity meter.

(a) What does the sound wave carry from the loudspeaker to the meter?

Put a (ring) around the correct answer.

air **energy** **light** **photons**

[1]

(b) Dave sets the frequency of the signal generator to 680 Hz.

The speed of sound waves is 340 m/s.

This makes the wavelength of the sound waves 0.5 m.

Complete the sentences. Choose numbers from this list.

0.5 **340** **680**

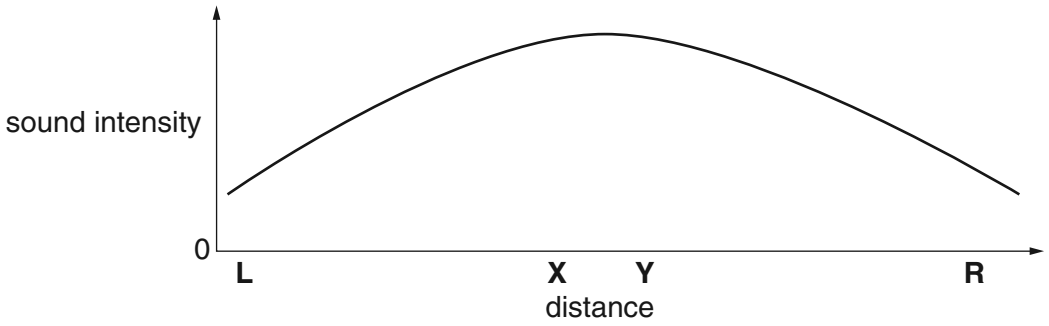
In one second, the loudspeaker emits ..... sound waves.

Each of the waves moves ..... metres in that time.

The distance from the centre of one wave to the centre of the next is ..... metres.

[2]

(c) Dave plots this graph to show how the reading on the sound intensity meter changes as he walks in front of the wall from **L** to **R**.



Here are some possible explanations for the shape of the graph.

Put a tick (✓) in the box next to the **best** explanation.

The wall attracts the sound waves. ☐

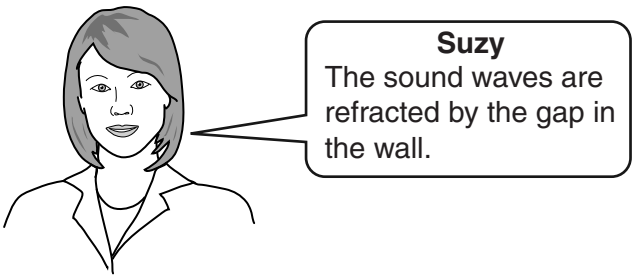
The sound waves are amplified by the wall. ☐

The gap in the wall absorbs the sound waves. ☐

The sound waves diffract as they go through the gap. ☐

[1]

(d) Suzy explains Dave's results **incorrectly**.



Which of these wave properties must change for **refraction** to take place?

Put a (ring) around the correct answer.

amplitude **frequency** **speed** **vibration**

[1]

[Total: 5]

2 Julie has a new digital TV.

(a) Her new TV uses optical fibre cable.

What carries the information through the optical fibre cable?

Put a (ring) around the correct answer.

infrared light **microwaves** **sound** **ultraviolet**

[1]

(b) Julie's old TV received analogue signals through a wire cable.

The picture quality wasn't very good.

This was because the signal picked up noise in the cable.

Her new TV gives a very clear picture.

Explain why noise doesn't affect **digital** TV.

Your answer should include a description of

- a digital signal
- noise.

.....

.....

.....

.....

.....

..... **[3]**

[Total: 4]

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3 A laser is a special high intensity source of visible electromagnetic waves (light).

(a) All of the photons from the laser are identical.

They have the same direction, energy, frequency and wavelength.

State another property which will be the same for all of the photons.

..... **[1]**

(b) The beam of light from a laser has a high intensity.

Which of these statements about intensity is correct?

Put a tick (✓) in the box next to the correct statement.

Intensity is the speed of each photon. ☐

Intensity is the energy arriving per second. ☐

Intensity is the number of photons in the beam. ☐

Intensity is the amplitude of each photon in the beam. ☐

[1]

(c) Joe finds another laser. It produces photons with more energy.

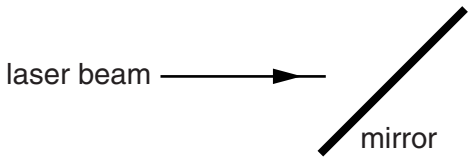
Which wave property is changed to alter the energy of the photons?

Put a (ring) around the correct answer.

amplitude **frequency** **rotation** **velocity**

[1]

(d) The diagram shows a laser beam approaching a mirror.

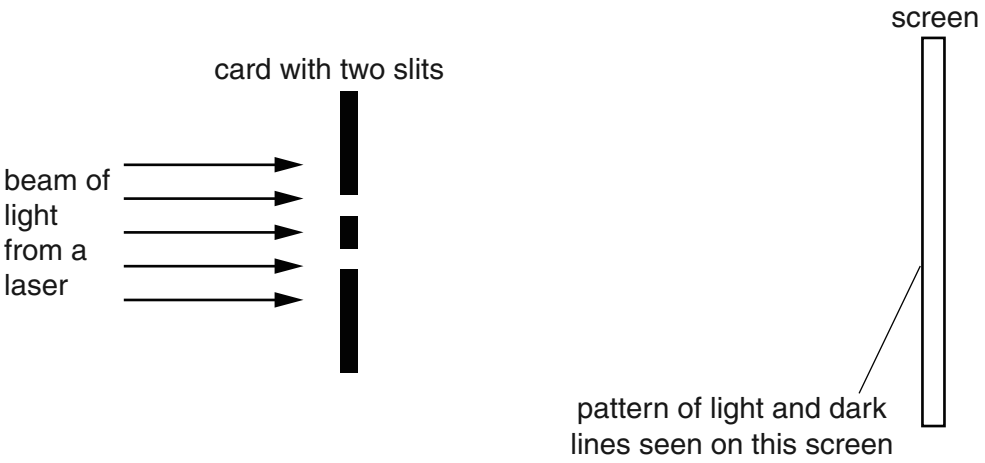


Complete the diagram to show the laser beam reflecting off the mirror. **[1]**

(e) Joe places a piece of card in the path of a laser beam.

The card has two slits. The slits let two beams of light pass through to a screen.

Joe sees a pattern of light and dark lines on the screen.



What is the name given to the **pattern** of lines?

Put a (ring) around the correct name.

construction **destruction** **interference** **linear**

[1]

[Total: 5]

4 Julia accidentally stabs her finger with a sharp pin.

She pulls her hand back from the pin.

This is a simple reflex action.

(a) The reflex happens in stages.

The stages are written below in the wrong order.

Put the stages in the correct order by writing **A**, **B**, **C**, **D** and **E** in the boxes.

The first one has been done for you.

A receptor detects stab

B signal sent along motor neuron

C signal sent along sensory neuron

D signal makes muscle contract

E signal crosses synapse

A				

[3]

(b) Which statements are true of simple reflex actions?

Put ticks (✓) in the boxes next to the **two** correct statements.

Simple reflex actions …

… give fast responses. ☐

… only happen in adults. ☐

… are involuntary. ☐

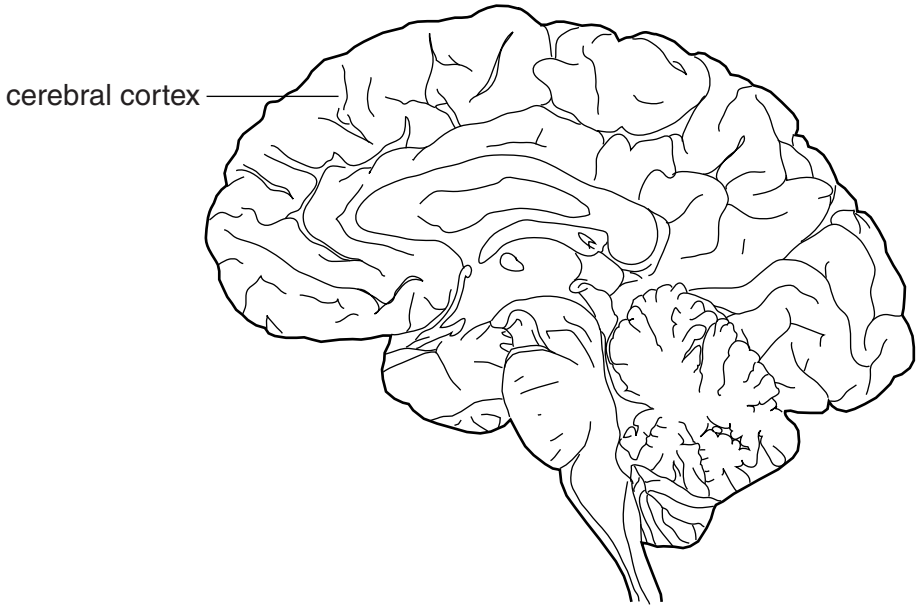
… do not need any change in the environment. ☐

… are only found in humans. ☐

[2]

[Total: 5]

5 This question is about the cerebral cortex of the human brain.



The cerebral cortex has a number of jobs.

Write down one of these jobs and describe how scientists can find out which area of the cerebral cortex does this.

.....

.....

.....

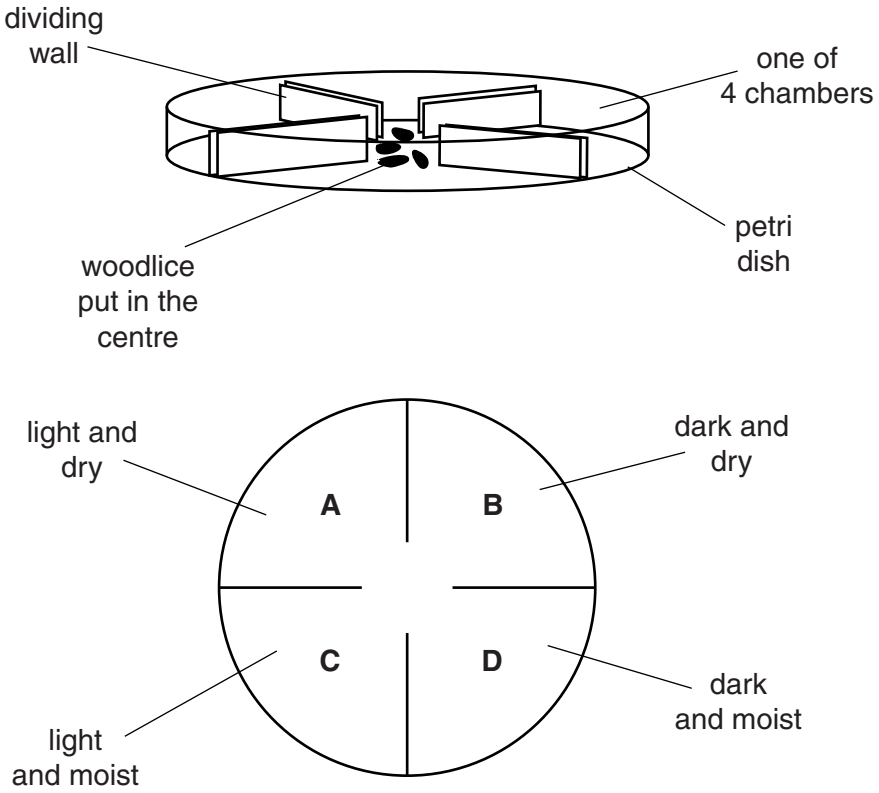
.....

..... **[3]**

[Total: 3]

6 Emily does an experiment with woodlice.

She puts 30 woodlice into the centre of a Petri dish so that they can move freely into four chambers, **A**, **B**, **C** and **D**. Each chamber has different conditions.



After five minutes, Emily counts the woodlice in each chamber.

She records her results in a table.

chamber	conditions	number of woodlice
A	light and dry	2
B	dark and dry	10
C	light and moist	6
D	dark and moist	12

(a) What is the percentage of woodlice in chamber **D**?

answer ..... % **[1]**

(b) Look at Emily's results.

Which condition appears to attract the woodlice most?

Put a (ring) around the correct answer.

dark **dry** **light** **moist**

[1]

(c) The type of behaviour shown by the woodlice helps them to survive.

Suggest two ways that it does this.

Put ticks (✓) in the boxes next to the **two** best answers.

It helps to protect them from birds. ☐

It allows them to respond to new conditions. ☐

It helps them to investigate different habitats. ☐

It prevents the Sun from drying them out. ☐

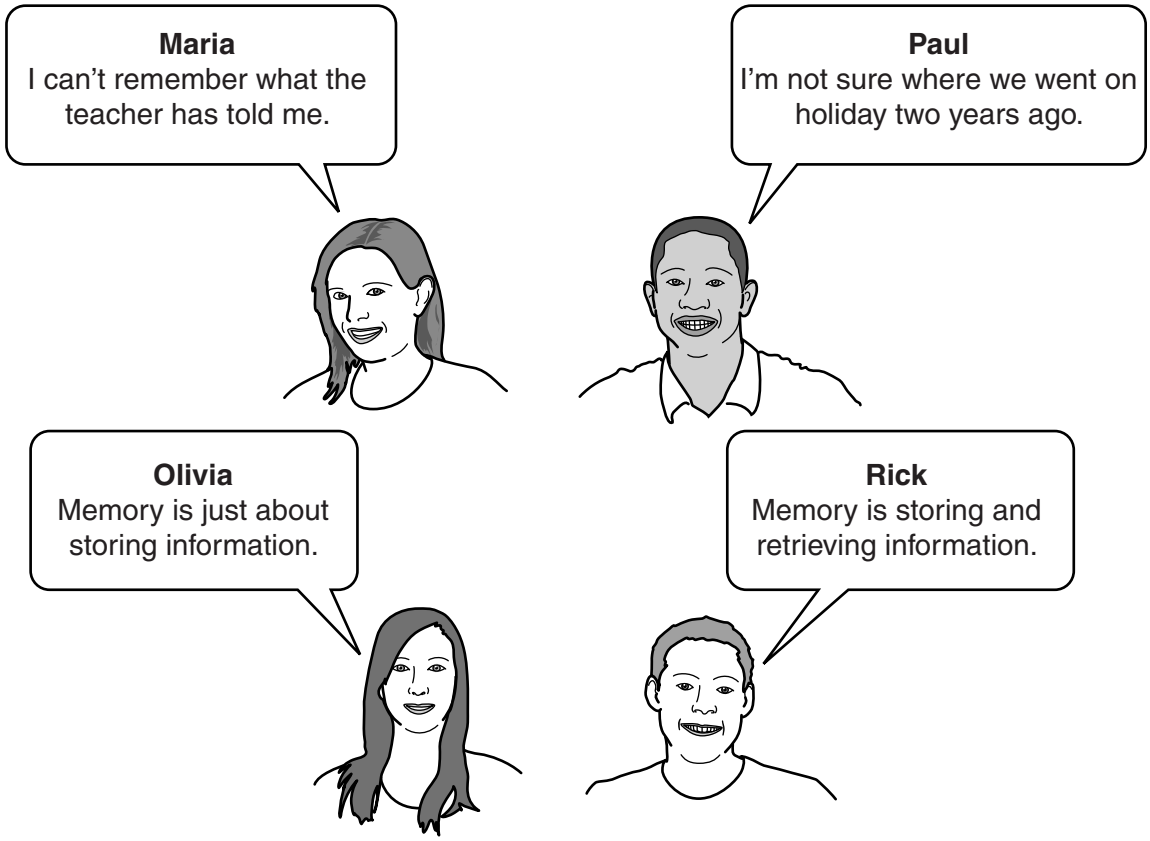
It allows them to make food. ☐

It helps them to avoid competition with other woodlice. ☐

[2]

[Total: 4]

7 Four friends are discussing memory.



(a) Who is describing a problem with their short-term memory?

answer ..... **[1]**

(b) Who correctly describes what memory is about?

answer ..... **[1]**

[Total: 2]

8 A chemical company has discovered a new way of making a medicine.

The new method gives a higher yield than the old method.

(a) When the starting chemicals are put together two different chemical reactions happen.

One reaction makes the medicine.

The other reaction makes no medicine at all.

Reaction 1 starting chemicals ⟶ medicine + by products

Reaction 2 starting chemicals ⟶ other different substances

The mass of the starting chemicals is not the same as the mass of the medicine made.

Explain

- **how** the mass of the starting chemicals is different from the mass of the medicine
- **why** the mass of the starting chemicals is different from the mass of the medicine.

.....

.....

.....

.....

..... **[3]**

(b) The starting chemicals should make 5,000 tonnes of the medicine.

They actually make 4,500 tonnes.

(i) What is the percentage yield for the reaction?

Put a (ring) around the correct answer.

10% **11.1%** **45%** **80%** **90%**

[1]

(ii) Show how you worked out your answer.

[1]

[Total: 5]

9 The diagram shows lead nitrate solution being added to potassium iodide solution.

It makes a yellow precipitate of lead iodide.

Lead iodide does not dissolve in water.

The word equation for the reaction is

lead nitrate(aq) + potassium iodide(aq) ⟶ lead iodide(s) + potassium nitrate(aq)

(a) Julie adds a very small amount of lead nitrate solution to potassium iodide solution.

Which chemicals will be **dissolved** in the water **after** she has done this?

Put ticks (✓) in the boxes next to the correct answers.

lead iodide ☐

lead nitrate ☐

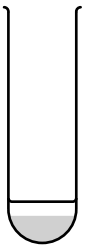
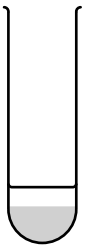
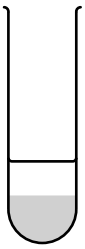
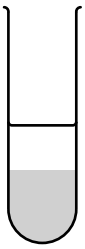
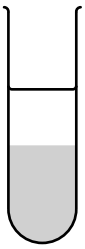
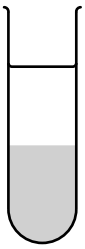
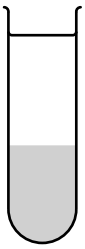
potassium iodide ☐

potassium nitrate ☐

[1]

(b) Julie puts 5 cm^3 of potassium iodide solution into each of seven test tubes.

She adds a different amount of lead nitrate solution to each tube.

tube number	1	2	3	4	5	6	7
volume of potassium iodide solution	5 cm^3	5 cm^3	5 cm^3	5 cm^3	5 cm^3	5 cm^3	5 cm^3
volume of lead nitrate solution	2 cm^3	4 cm^3	6 cm^3	8 cm^3	10 cm^3	12 cm^3	14 cm^3
diagram of results							
height of precipitate	1 cm	2 cm	3 cm	4 cm	5 cm	5 cm	5 cm

In this experiment, what is the smallest volume of lead nitrate solution that was needed to use up all of the potassium iodide solution in the reaction?

volume = ... cm^3 **[1]**

(c) The precipitate is not clean. There are traces of dissolved chemicals mixed in with it.

How can she get a clean dry sample of lead iodide from the reaction mixture?

Describe the **three** steps she has to take.

.....

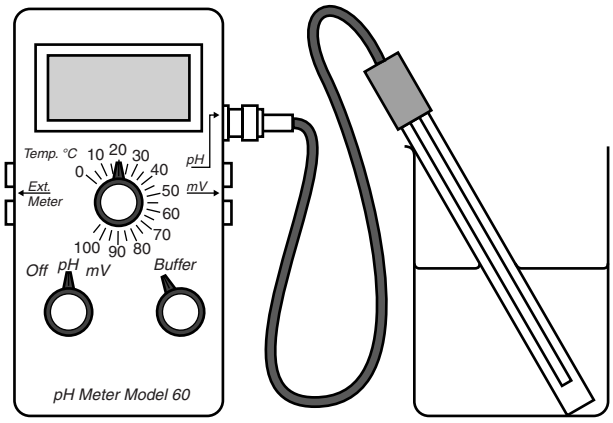
.....

.....

..... **[3]**

[Total: 5]

10 Nick reacts hydrochloric acid with sodium hydroxide.



(a) The formula of sodium hydroxide is NaOH.

What is the formula of hydrochloric acid?

Put a (ring) around the correct answer.

HCl **H_2SO_4** **HNO_3**

[1]

(b) What happens when an acid reacts with an alkali?

Put ticks (✓) in the boxes next to the **two** correct statements.

A salt is made. ☐

Water is made. ☐

There is an explosion. ☐

A carbonate is made. ☐

An indicator is made. ☐

[1]

(c) Nick checks the pH of the alkali with a pH meter before he starts.

What is the reading on the pH meter?

Put a (ring) around the correct answer.

1 **4** **6** **7** **14**

[1]

(d) When any acid dissolves in water, H^+ ions are produced.

What ions are produced when any alkali dissolves in water?

Put a (ring) around the correct answer.

H^+ **Cl^-** **Na^+** **OH^-**

[1]

[Total: 4]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.